Remarks: Examination Report

1. Claims 1-21 are pending.

2. Claims 1-16 and 19-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Proakis (U.S. 5,844,951) in view of Thomas (U.S. 6,141,393) and Agee (U.S. 6,128,276).

3. With regard to each Claim 1-16 and 19-21, the Examiner states that Proakis teaches transforming an input signal into a plurality of spectral components, Thomas teaches providing for computation of a set of weights and combining weighted components by a receiver array, and Agee teaches a code-nulling technique that separates received coded signals and ***compensates for channel distortion***.

4. Applicant submits that the above-recited steps (and related apparatus components) of providing for transformation of an input signal into a plurality of spectral components, providing for computation of a set of weights with respect to the complex amplitude-versus-frequency profiles, providing for application of said weights to said spectral components, and providing for combining across the weighted spectral components to cancel co-channel interference, such as recited in the Independent Claim 1 (and hence in the dependent claims 2-3) presents a novel method that the cited combination of prior-art references neither describe nor anticipate.

5. Applicant submits that the above-recited steps of providing for transformation of a discreet-time input signal into a plurality of spectral components, the discreet-time input signal including the plurality of interfering signals, the spectral components having differences in either or both amplitude variations and phase variations, and providing for separation of the interfering signals by processing either or both the amplitude variations and the phase variations across the plurality of spectral

components in the Independent Claim 4 (and hence in the dependent claims 5-6) presents a novel method that the cited combination of prior-art references neither describe nor anticipate.

6. Applicant submits that the above-recited steps of providing for transformation of a receive signal into a plurality of non-spatial diversity components, the receive signal including a plurality of the interfering signals, the non-spatial diversity components having differences in either or both amplitude distributions and phase distributions, and providing for separation of the interfering signals by processing either or both the amplitude variations and the phase variations across the plurality of non-spatial diversity components in the Independent Claim 7 (and hence in the dependent claims 8-10) presents a novel method that the cited combination of prior-art references neither describe nor anticipate.

7. Applicant submits that the above-recited diversity receiver adapted to separate the received signals into a plurality of frequency components and the frequency-domain spatial interferometry demultiplexer adapted to provide frequency-domain processing to the plurality of frequency components to separate at least one information signal from at least one interfering signal in the Independent Claim 11 (and hence in the dependent claim 12) presents a novel structure that the cited combination of prior-art references neither describe nor anticipate.

THE PRIOR ART TEACHES AWAY FROM CLAIMED INVENTION

MPEP 2141.02 states that a prior art reference must be considered in its entirety, i.e., as a <u>whole</u>, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

MPEP 2145 Section X, Subsection D states that a prior art reference that "teaches away" from the claimed invention is a significant factor to be considered in determining

obviousness. *re Grasselli,* 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). MPEP 2145 Section X, Subsection S, Paragraph 3 states that proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. *In re Hedges,* 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986).

The present invention exploits multipath fading and interference for improving spectral efficiency. The prior art identifies multipath fading and interference as problems that hinder spectral efficiency, and the prior art teaches to suppress the effects of multipath fading and interference.

- Proakis describes multipath as a "***problem***" (col. 1, lines 50-52), which should be suppressed to enable "efficient use of the available bandwidth" (col. 1, line 64- col. 2, line 2). Furthermore, multipath greatly increases the complexity of beamforming in Proakis. As the number of paths "P" increases, the size of the beamforming matrix (col. 8, lines 1-6) increases. Proakis recognizes that two receivers may be used for diversity combining if they are far enough apart to ensure independence between the received signals (col. 2, lines 17-22). Thus, Proakis uses diversity combining to mitigate multipath fading (col. 2, lines 31-36).

- Thomas describes multipath as a ***problem*** that "limits the achievable performance and capacity of a communication system" (col. 1, lines 21-25) by causing "***unwanted*** variations in the received signal strength over the bandwidth occupied by the signal" (col. 1, lines 45-47). Thus, Thomas teaches to "***suppress*** the effects of co-channel interference" in order to "better utilize the available spectrum" (col. 2, lines 23-25, col. 3, lines 10-14, col. 4, lines 27-34).

- Agee recognizes that a multipath channel de-orthogonalizes orthogonal multiple-access codes. Thus, Agee employs "code nulling" to ***correct*** (rather than ***exploit***) channel distortions that cause co-channel interference (col. 11, lines 5-9). Code nulling may be done in conjunction with adaptive antenna array processing due to the convenience of using the same algorithm (e.g., SCORE) for both.

Proakis, Thomas, and Agee fail to recognize that channel effects (e.g., multipath channel effects) may be used to differentiate one transmitter from another when both transmitters are transmitting in the same frequency band at the same time. Specifically, the claimed invention employs interference cancellation that ***exploits*** the multipath channel distortion to increase the number of transmitters that can share a common frequency band or code. Furthermore, this is achieved without having to resort to antenna-array processing or employ different transmission codes at each transmitter.

Therefore, since the present invention improves spectral efficiency in a way that is contrary to accepted wisdom in the art, the present invention is non-obvious under 35 U.S.C. 103.

THE PRIOR-ART REFERENCES AND THE KNOWLEDGE GENERALLY AVAILABLE TO ONE OF ORDINARY SKILL IN THE ART FAIL TO SUGGEST OR TEACH THE INVENTION

MPEP 2142 states that to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior-art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.

THE PRIOR ART FAILS TO SUGGEST THE DESIRABILITY OF THE CLAIMED INVENTION

MPEP 2143.01 states that the prior art must suggest the desirability of the claimed invention *In re Rouffet,* 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998).

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab,* 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Lee,* 277 F.3d 1338, 1342-44, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002) (discussing the importance of relying on objective evidence and making specific factual findings with respect to the motivation to combine references); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The prior-art references, Proakis, Thomas, and Agee, fail to suggest the desirability of the claimed invention.

1. The prior-art references teach spatial demultiplexing and/or code demultiplexing for separating signals occupying the same channel. Particularly, Proakis and Thomas employ antenna arrays for spatial division multiplexing, and Agee teaches to use antenna arrays and also to employ a different multiple-access code for each transmission. Proakis, Thomas, and Agee each identify channel distortions (i.e., multipath effects) as ***problems*** for multiple access. Furthermore, each of these prior-art references teaches to ***mitigate these problems*** by suppressing the multipath effects. The prior art fails to show any shortcomings of suppressing the effects of multipath. Therefore, the prior art fails to show any motivation whatsoever to ***exploit***, rather than ***suppress***, channel distortions in the way achieved by the present invention for enhancing multiple access.

2. The prior art teaches against the claimed invention by identifying multipath as a problem that impedes multiple access rather than an opportunity to enhance multiple access. Therefore, a combination of Proakis, Thomas, and Agee that could produce the claimed invention is ***expressly taught against*** by the prior art.

Since Proakis, Thomas, and Agee identify antenna-array processing and different multiple access codes as preferred ways to enhance spectrum efficiency, there is no motivation to change these approaches to resemble the claimed invention. Since Proakis, Thomas, and Agee also teach to suppress the effects of multipath to enhance spectrum efficiency, there is no motivation or suggestion in the prior art to employ a ***contrary*** approach to dealing with multipath that also enhances spectrum efficiency. In fact, it would be ***unreasonable*** for someone skilled in the art to expect success by using multipath effects to improve spectral efficiency. Therefore, the invention is non-obvious under 35 U.S.C. 103.

THE FACT THAT REFERENCES CAN BE COMBINED OR MODIFIED IS NOT SUFFICIENT TO ESTABLISH *PRIMA FACIE* OBVIOUSNESS

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." 916 F.2d at 682, 16 USPQ2d at 1432.). See also *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992).

Each of the prior-art reference Proakis, Thomas, and Agee are characterized by motivations that substantially differ from those of the present invention. Proakis, Thomas, and Agee teach to use antenna arrays to separate received transmissions occupying the same channel. Agee teaches to employ different transmission codes for each transmitter in order to achieve multiple access.

The prior art does not recognize that delay profiles and frequency-selective fading may be used to separate transmitted signals that use the same spectrum or spreading code. Rather, Proakis, Thomas, and Agee all teach to avoid channel distortions and to correct for such distortions. Conversely, the present invention teaches that such distortions are preferable because they enable a receiver to separate co-channel transmissions. The prior art clearly fails to recognize the desirability and the principle of operation of the claimed invention.

THE FACT THAT THE CLAIMED INVENTION IS WITHIN THE CAPABILITIES OF ONE OF ORDINARY SKILL IN THE ART IS NOT SUFFICIENT BY ITSELF TO ESTABLISH *PRIMA FACIE* OBVIOUSNESS

A statement that modifications of the prior art to meet the claimed invention would have been " 'well within the ordinary skill of the art at the time the claimed invention was made' " because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See also *In re Kotzab,* 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1318 (Fed. Cir. 2000).

There is no known principle or specific understanding within the knowledge of a skilled artisan that would have motivated the skilled artisan to make the claimed invention. While it is known that different frequencies undergo different fades in a multipath environment (e.g., Thomas, col. 3, lines 63-65 and Agee, col. 1, lines 50-59), it was not known in the prior art that different multipath fades could be used to differentiate between two or more spectrally identical transmissions. Rather, the prior-art teaches to correct for (i.e., equalize) multipath effects (Proakis, col. 1, line 64- col. 2, line 2; Thomas, col. 2, lines 23-25, col. 3, lines 10-14, col. 4, lines 27-34; and Agee, col. 11, lines 5-9). Therefore, there is no motivation to combine the prior-art references in a way to produce the claimed invention because it was unknown that multipath effects that

change the spectral distributions of transmissions can be exploited to separate those transmissions, thus improving spectral efficiency in a wireless communication system.

THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)

While Proakis claims to make use of multiple signal paths via diversity combining (col. 2, lines 56-60), the purpose is to coherently combine the reflections in order to ***mitigate*** multipath fading (col. 2, lines 32-36). A modification to Proakis that produces the present invention ***preserves*** the multipath fading in order to separate received transmissions. Therefore, the proposed modification contradicts the intended purpose of Proakis, because such a modification does not mitigate multipath fading.

THE PROPOSED MODIFICATION WOULD CHANGE THE PRINCIPLE OF OPERATION OF A REFERENCE

If the proposed modification or combination of the prior art would change the principle of operation of the prior-art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

- Each prior-art reference, Proakis, Thomas, and Agee, requires that multipath fading and interference be suppressed to improve spectral efficiency. However, the claimed invention teaches to exploit multipath fading and interference for improving spectral efficiency. Any modification of Proakis (such as by combining elements from Thomas and Agee) to enable separation of received signals by virtue of their multipath fading changes the principle of operation of Proakis. Specifically, such a

modification entails exploiting spectral differences between received signals in order to distinguish them from each other, whereas Proakis teaches to equalize such differences via diversity combining and equalization. Furthermore, neither Thomas nor Agee teaches to exploit multipath differences between received signals in order to spatially demultiplex the received signals. In fact, Thomas and Agee both teach to suppress multipath effects. Therefore, there is no suggestion in the prior art to change the operation of Proakis (nor Thomas or Agee) from suppressing multipath effects to exploiting multipath effects.

THE PRESENT INVENTION SOLVES A DIFFERENT PROBLEM THAN THE PRIOR ART

Specifically, the present invention performs spatial demultiplexing of received transmissions, even when only one antenna element is used and the transmissions share the same bandwidth or spreading code. The present invention enables spatial demultiplexing to be performed with fewer antenna elements. Thus, the present invention provides ***new and unexpected results*** that no other prior-art reference can provide.

Conversely, the other prior-art references use antenna-array processing or some other well-known multiple-access scheme (e.g., Code Division Multiple Access) to differentiate between one transmitter and another;

- Proakis teaches an antenna array to coherently combine multiple signal reflections (col. 2, lines 56-60) for angular directivity (col. 3, lines 12-14). Antenna arrays can differentiate between received signals that are separated by a minimum angle of arrival relative to the broadside of the array. Proakis describes array beamforming as a means for differentiating between different propagation paths, or angles of arrival (col. 8, lines 1-6, col. 9, lines 13-22, and col. 10, line 51-col. 11, line 36).
- Thomas teaches an antenna array that can adapt its angular response (col. 3, lines 18-34). Thomas teaches antenna-array processing that allows for spatial division multiple

access (SDMA), which enables angularly separated transceivers to share the same channel (col. 3, lines 35-43).

- Agee teaches antenna array processing (col. 3, lines 1-12). Agee also specifies that ***different*** multiple-access codes be used for each transmitter (col. 4, lines 36-44, col. 13, lines 38-40, col. 14, lines 8-10) and then uses code nulling to ***correct*** for the channel distortions (col. 11, lines 5-9), as well as demultiplex the coded signals.

Thus, the combination of Proakis, Thomas, and Agee is incapable of differentiating between same-frequency (and same-coded) signals that are substantially co-linear. Furthermore, the combination of Proakis, Thomas, and Agee is incapable of differentiating between any same-frequency (and same-coded) signals using a single antenna element, since the angle of arrival is not relevant in the case of a single antenna element.

Thus, the present invention solves the problem of interference from two or more transmitters sharing the same spectrum, whereas prior-art solutions (such as Agee) resort to using different multiple-access codes and/or using antenna-array beamforming.

The present invention solves this problem (i.e., of interference from two or more transmitters sharing the same spectrum) in a novel way that the prior-art references teach against. Specifically, the present invention exploits channel distortions to help differentiate between same-frequency signals transmitted by different transmitters, whereas the prior art teaches to correct for channel distortions (Agee, col. 11, lines 5-9).

Thus, the ability to separate (i.e., spatially demultiplex) received common-frequency signals using a single antenna element provides new and unexpected results that are not described nor anticipated by the prior art, making the invention non-obvious under 35 U.S.C. 103.

8. As detailed above, the cited art describes a different type of signal processing to that claimed by the present invention. Although different to the present invention, such signal-processing protocols have use, as is evidenced by the teaching of the prior art. Such use is served by the Proakis, Thomas, and Agee for equalizing channel distortions and spatial demultiplexing signals with multi-antenna receivers, and there is no teaching in the prior art to change the type of signal-processing protocols provided so as to resemble or reflect that of the present invention. As there is no motivation to change, no teaching to change, and no description of how any change may be made to achieve spatial demultiplexing by processing non-spatial signal components, such as described in the methods and apparatus disclosed in Applicant's invention, it is submitted that the presently claimed invention is non-obvious, making the claims patentable under 35 U.S.C. 103.

9. Claims 17 and 18 are allowed.

10. Claims 13-16 and 19-21 should be allowed under 35 U.S.C. 103 because they contain the same limitations recited in Claims 17 and 18.

11. Independent Claim 13 (and thus, Dependent Claim 14) recites providing for generation of at least one wideband electromagnetic signal, providing for impressing an information signal onto the at least one wideband signal to produce at least one spread-spectrum signal, providing for duplicating the spread-spectrum signal to generate a plurality of spread-spectrum signals, providing for diversity-encoding of at least one of the spread-spectrum signals, and correlating the spread spectrum signals at the receiver.

12. With regard to Independent Claims 13, the Examiner states that Proakis teaches generating a wideband signal and impressing an information signal on the wideband signal to produce at least one spread-spectrum signal (col. 2, line 45- col. 3, line 66; col. 12, line 43- col. 13, line 46) and Thomas teaches receiving data symbols and pilot

symbols and **computing a channel transfer function** (col. 4, line 40- col. 5, line 54; col. 7, line 3- col. 8, line 25; col. 9, line 38- col. 10, line 55). Agee teaches code nulling and adjusting spreading codes for **compensating for channel distortion**.

13. Conversely, the present invention does not require computing a channel transfer function and compensating for channel distortion. This is because diversity-encoding at least one of the spread-spectrum signals (such as recited in Claim 13) provides a coded signal and an uncoded signal that both experience similar channel distortions. Thus, the receiver requires only correlating the received spread spectrum signals, whereas the cited combination of references Proakis, Thomas, and Agee requires computing a channel transfer function and compensating for channel distortion.

14. Independent Claim 15 (and thus, Dependent Claim 16) recites providing for generating at least one information-bearing wideband radio signal, providing for generating at least one decoding signal for correlating with the at least one information-bearing wideband radio signal at a receiver to recover at least one information signal, and providing for diversity-encoding of at least one of the information-bearing wideband signal and the decoding signal.

15. With regard to Independent Claims 15, the Examiner states that Proakis teaches generating a wideband signal modulated with information (col. 2, line 45- col. 3, line 66; col. 12, line 43- col. 13, line 46) and Thomas teaches receiving data symbols and pilot symbols and **computing a channel transfer function** (col. 4, line 40- col. 5, line 54; col. 7, line 3- col. 8, line 25; col. 9, line 38- col. 10, line 55). Agee teaches code nulling and adjusting spreading codes for **compensating for channel distortion**.

16. Conversely, the present invention does not require computing a channel transfer function and compensating for channel distortion. This is because diversity-encoding at least one of the spread-spectrum signals (such as recited in Claim 13) provides a coded signal and an uncoded signal that both experience similar channel distortions.

Thus, the receiver requires only correlating the received spread spectrum signals, whereas the cited combination of references Proakis, Thomas, and Agee requires computing a channel transfer function and compensating for channel distortion.

17. Furthermore, the method of providing for a correlation process at a receiver to correlate the plurality of spread-spectrum signals for recovering the information signal, such as recited in Claim 13, and the method of providing for generating at least one decoding signal for correlating with the at least one information-bearing wideband radio signal at a receiver to recover at least one information signal recited in Claim 15 are substantially different than the receiver techniques described by Proakis, Thomas, and Agee.

18. In particular, the correlation process recited in the claimed invention employs the received signals to recover modulated information. Thus, rather than requiring diversity combining, channel estimation, and equalization to compensate for the channel response (such as recited in Proakis, col. 2, line 56- col. 3, line 14, and in Thomas, col. 4, lines 40-55), the invention employs a plurality of spread-spectrum signals that experience substantially identical channel conditions. Correlations between the spread-spectrum signals provide a means to recover modulated information without having to compensate for channel distortions. Conversely, Thomas requires calculating the channel frequency response prior to equalization or combining (col. 4, lines 40-50). Agee employs "code nulling" to ***correct*** channel distortions that cause co-channel interference (col. 11, lines 5-9). The claimed invention recites correlating two or more signals (which have substantially the same frequency response) in order to provide for information recovery **without requiring channel estimation and equalization**.

19. Finally, the methods recited in Independent Claims 13 and 15 do not require a receiver array to perform spatial demultiplexing, whereas the methods described by both Proakis, Thomas, and Agee describe receiver arrays.

20. Independent Claim 19 recites a receiving system adapted to receive the diversity-coded spread-spectrum signals, a diversity processor coupled to the receiving system, the diversity processor adapted to diversity decode at least one of the received signals to provide a plurality of signals that are highly correlated, and a signal correlator coupled to the diversity processor, the signal correlator adapted to correlate the plurality of highly correlated signals to generate a correlation signal indicative of the information signal.

21. With regard to Independent Claim 19, the Examiner states that Proakis discloses a receiving system adapted to receive diversity encoded signals and a diversity processor adapted to diversity decode the received signals (col. 2, line 45- col. 3, line 66; col. 12, line 43- col. 13, line 46) and Thomas discloses receiving data symbols and pilot symbols and **computing a channel transfer function** (col. 4, line 40- col. 5, line 54; col. 7, line 3- col. 8, line 25; col. 9, line 38- col. 10, line 55). Agee teaches code nulling and adjusting spreading codes for **compensating for channel distortion.**

22. Conversely, the present invention does not require computing a channel transfer function and compensating for channel distortion. This is because diversity-encoding at least one of the spread-spectrum signals (such as recited in Claim 19) provides a coded signal and an uncoded signal that both experience similar channel distortions. Thus, the receiver requires only correlating the received spread spectrum signals, whereas the cited combination of references Proakis, Thomas, and Agee requires computing a channel transfer function and compensating for channel distortion.

23. In particular, the claimed invention correlates the plurality of highly correlated signals to recover modulated information. Thus, rather than requiring diversity combining, channel estimation, and equalization to compensate for the channel response (such as recited in Proakis, col. 2, line 56- col. 3, line 14, and in Thomas, col. 4, lines 40-55), the invention employs a plurality of spread-spectrum signals that experience

substantially identical channel conditions. Correlations between the spread-spectrum signals provide a means to recover modulated information without having to compensate for channel distortions. Conversely, Thomas requires calculating the channel frequency response prior to equalization or combining (col. 4, lines 40-50). Agee employs "code nulling" to ***correct*** channel distortions that cause co-channel interference (col. 11, lines 5-9). The claimed invention recites correlating two or more signals (which have substantially the same frequency response) in order to provide for information recovery **without requiring channel estimation and equalization**.

24. Claim 20 recites a receiving system adapted to receive the at least one diversity-coded signal and at least one despreading signal, the despreading signal being separable from the at least one diversity-coded signal, a diversity processor coupled to the receiving system, the diversity processor adapted to diversity decode at least one of the at least one diversity-coded signal and the at least one despreading signal, and a signal correlator coupled to the diversity processor, the signal correlator adapted to correlate the at least one diversity-coded signal with the at least one despreading signal to generate a correlation signal indicative of the information signal.

25. With regard to Independent Claim 20, the Examiner states that Proakis discloses a receiving system and a diversity processor (col. 2, line 45- col. 3, line 66; col. 12, line 43- col. 13, line 46) and Thomas discloses receiving data symbols and pilot symbols and **computing a channel transfer function** (col. 4, line 40- col. 5, line 54; col. 7, line 3- col. 8, line 25; col. 9, line 38- col. 10, line 55). Agee teaches code nulling and adjusting spreading codes for **compensating for channel distortion**.

26. Conversely, the present invention does not require computing a channel transfer function and compensating for channel distortion. This is because diversity-encoding at least one of the spread-spectrum signals (such as recited in Claim 20) provides a coded signal and an uncoded signal that both experience similar channel distortions. Thus, the receiver requires only correlating the received spread spectrum signals,

whereas the cited combination of references Proakis, Thomas, and Agee requires computing a channel transfer function and compensating for channel distortion.

27. In particular, the claimed invention correlates the plurality of highly correlated signals to recover modulated information. Thus, rather than requiring diversity combining, channel estimation, and equalization to compensate for the channel response (such as recited in Proakis, col. 2, line 56- col. 3, line 14, and in Thomas, col. 4, lines 40-55), the invention employs a plurality of spread-spectrum signals that experience substantially identical channel conditions. Correlations between the spread-spectrum signals provide a means to recover modulated information without having to compensate for channel distortions. Conversely, Thomas requires calculating the channel frequency response prior to equalization or combining (col. 4, lines 40-50). Agee employs "code nulling" to ***correct*** channel distortions that cause co-channel interference (col. 11, lines 5-9). The claimed invention recites correlating two or more signals (which have substantially the same frequency response) in order to provide for information recovery **without requiring channel estimation and equalization**.

28. Applicant submits that the above recited signal correlator adapted to correlate the plurality of highly correlated signals to generate a correlation signal indicative of the information signal in the Independent Claim 19 and the above recited signal correlator adapted to correlate the at least one diversity-coded signal with the at least one despreading signal to generate a correlation signal indicative of the information signal in the Independent Claim 20 presents novel structure that the cited combination of prior-art references neither describe nor anticipate.

29. In particular, providing correlation of a plurality of received signals circumvents the need for channel equalization and diversity combining described in both Proakis (col. 2, lines 46-50) and Thomas (col. 4, lines 50-55). Thus, Proakis, Thomas, and Agee teach to estimate the channel, and then correct (i.e., equalize) the channel distortion. Conversely, the claimed invention employs a plurality of signals transmitted through substantially the same channel, and thus the received signals have similar channel

distortions. The received signals are then correlated with each other to recover the modulated information without requiring channel equalization.

30. Since the claimed invention can perform spatial demultiplexing by correlating received signals via non-spatial (e.g., spectral, temporal, etc.) diversity components, the invention does not require a plurality of receiver antennas to achieve spatial demultiplexing. Similarly, the invention may use fewer receiver antennas to spatially demultiplex a given number of signals than in conventional multiple-antenna receivers (such as described on page 9, lines 3-6 of the Specification), whereas the maximum number of interfering signals that prior-art antenna systems can process cannot exceed the number of receiver antennas.

31. **The combination of prior-art references, Proakis, Thomas, and Age, fails to teach a system having a correlator that correlates received signals that have underwent substantially identical channel effects. Since the cited combination of prior-art references, Proakis, Thomas, and Agee, fails to recite all of the components in the claims 13-16 and 19-20, the rejection under 35 U.S.C. 103 should be withdrawn.**

32. With regard to Independent Claim 21, the recited nonlinear processor adapted to apply a nonlinear process to at least one signal of the algebraically unique combination of information signals to increase the number of the at least one algebraically unique combination presents novel structure that the prior art references fail to describe.

33. **The combination of prior-art references, Proakis, Thomas, and Age, fails to teach a system that applies a nonlinear process to received signals. Since the cited combination of prior-art references, Proakis, Thomas, and Agee, fails to recite all of the components in the claim 21, the rejection under 35 U.S.C. 103 should be withdrawn.**

The Cited but Non-Applied References

34. These subsidiary references have been studied, but are submitted to be less relevant than the relied-upon references.

35. Conclusion

The Applicant submits that every effort has been made to address the Examiner's objection and that the Application is now in condition to proceed to grant.

Very respectfully,

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